

From: Michelle Klose <maklose@nd.gov>
To: Alicia <awaters@gp.usbr.gov>
Date: 1/8/2008 12:27:34 PM
Subject: Draft NAWS EIS cost information

Alicia Waters,

The State will be providing written comments to the draft EIS during the comment period. One of the comments from the Water Commission will relate to the cost estimates for the Floc/Sed option compared to the filtration option. We believe there is a greater cost difference between these alternatives than identified in the draft EIS. Attached for your information is a memo providing details on our view of the cost differences.

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M E M O R A N D U M



To: Kevin Martin
From: Bill Lynard
Subject: Technical Evaluation of
Reclamation's Process Design and
Cost Estimate for Alternatives B
and C

Date: November 19, 2007
Reference: 1690125.01090060

We have reviewed Reclamation's report "Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design and Cost Estimates", June 2007 for consistency with design approach and criteria, and cost estimates. For Alternative B, we compared Reclamation's design approach with previous MWH concept designs (Settlement Offer layout and costs for a flocculation/sedimentation/UV and chloramination facility).

We prepared a review of the basic design criteria and have noted several major differences that need to be addressed:

1. Reclamation based the disinfection/inactivation analysis on the assumption that the entire 26 mgd flow would be processed using EPA disinfection credits (CT-log reduction tables) at a temperature of less than 0.5°C. This provided *Giardia* inactivation credits of about 0.34 log, which we confirmed using this assumption. This influences the contact time requirements in the clearwell and pipeline travel time allocations.

However, the following evaluations need to be incorporated in the analysis to more accurately determine appropriate CT values which relates to reactor sizing and costs.

During the summer (July through September) water temperatures range from about 14°C to over 20°C. Therefore using the CT tables at 15°C, the summer inactivation rates for *Giardia* are estimated at 0.94 log for free chlorine and 0.37 log for chloramine contact times. During the summer, at 26 mgd, the contact time in the pipeline was approximately 2.5 hour (9.5 miles of 36-inch DP).

In the winter, flows are about 6 mgd and the corresponding pipeline contact times approach 10.7 hours. Using winter water temperatures of less than 1°C for chloramines in the pipeline, *Giardia* inactivation is estimated to exceed 4 log inactivation.

2. The chlorine contact reactor was designed to average between a 5-minute and 10-minute contact time. This design, based on the Chloramine Challenge Study, results in DBP formation potential below future target levels. Therefore, we use a contactor sizing and configuration to meet this criteria at all flow levels.

This results in a much smaller clearwell volume and facility configuration than assumed in the Reclamation design.

3. From the review of the Reclamation Treatment Alternative C (Conventional Treatment – DAF) and Alternative B (Enhanced Coagulation), it appears that Reclamation substituted the DAF/filter facility for a high-rate sedimentation chamber using inclined plate settlers. All other facilities between the alternatives basically remain the same.

We evaluated the flocculation-sedimentation alternative from the perspective of the process layout and sizing used in the settlement offer design and have noted major cost saving potential compared to Reclamation Alternative B. Specific major elements of the adjustment include:

- a. Elimination of the equalization tank,
- b. Smaller clearwell/contact chamber,
- c. Reduction in building size from 70,000 square feet to 12,070 square feet,
- d. Elimination of sludge storage facility, tank and centrifuge system and replacement with much simpler but just as effective storage/decant structure,
- e. Elimination of incline plate settlers (at nearly \$5 million) with increased size of sedimentation reactors.

Each of these major adjustments influence other construction elements including excavation/backfill, electrical, instrumentation and control, HVAC, plumbing and mechanical costs and concrete. The projected total adjustment to the Reclamation estimates for the major cost elements is about \$19,800,000. Only the major elements were looked at for this comparison. Minor cost elements and unit price differences were evaluated but are not reported in this memo. A summary of the major elements and cost savings are summarized below.

Building Cost

Reclamation reported a total building cost of \$6,072,000 for a 70,000 square foot structure that encompassed the entire treatment operations. This structure included shops, offices, labs and miscellaneous other operational areas.

Under the revised layout we have three separate building structures (one of which is incorporated with the booster pump station) and a much smaller treatment operations building. These structures comprise a total of 12,070 square feet at a projected cost of \$1,640,500.

Net Difference.....\$4,432,000

Concrete Construction

Reclamation reported a concrete construction cost for the main treatment process system of about \$4,469,600.

Under the revised layout, using a larger sedimentation basin and including the UV system vaults and the concrete in the Cl_2/NA_4 chemical feed system, we have estimated the total concrete at 5157 CY at a cost of \$3,719,700.

Net Difference.....\$750,000

Eliminate Equalization Tank

Net Difference.....\$1,616,000

Excavation and Backfill

Reclamation estimated the excavation and backfill costs at \$727,300 and \$1,367,000, respectively for all structures.

Under the revised layout and considering the elimination of the equalization tank, downsizing the clearwell and elimination of the sludge processing complex, the excavation and backfill costs were estimated at \$120,525 and \$180,540, respectively.

Net Difference.....\$1,793,200

Clearwell Contactor

Reclamation estimated the clearwell at a cost of \$2,491,380 for concrete construction.

After downsizing to the original design to provide a 5-minutes contact time, the estimated concrete construction for this facility as associated with the booster pump station is \$705,800.

Net Difference.....\$1,785,580

Sludge Handling System

Reclamation provides a design concept for a sludge handling system consisting of a sludge storage building, sludge storage tank, centrifuge system and miscellaneous pumping systems for a cost of about \$1,832,290.

We proposed a sludge decanting/storage facility which we have employed at a number of our WTP projects. This type of sludge handling systems has proven equally effective. The estimated cost of the revised sludge storage system is \$931,000.

Net Difference.....\$901,300

Electrical and I&C

Total Reclamation costs for all electrical and I&C systems associated with the design was \$2,928,900.

Under the revised layout, the electrical and I&C costs were reduced to \$1,652,000. This included the main treatment process ,UV system, sludge pumping and the Cl₂/NH₄ system.

Net Difference.....\$1,276,900

HVAC System

Under the Reclamation design, the HVAC system and appurtenance facilities were sized for a 70,000 sf structure. The HVAC costs were estimated at \$1,393,250.

Using much smaller structures (12,070 square feet), the HVAC costs were estimated at \$214,000.

Net Difference.....\$1,179,250

Plumbing, Fire System and Shop Facilities

Reclamation estimated costs for these facilities for the larger building at \$945,100.

Under the revised design, using a much smaller building and eliminating the shop, a revised cost of \$423,000 was estimated.

Net Difference.....\$522,100

Mechanical

Reclamation had a total mechanical system cost of about \$8,052,000. Of this cost, \$4,970,000 is for inclined plate settlers in the sedimentation tank.

Under our design, we have used a larger sedimentation reactor and have eliminated the plate settlers. We also reviewed the other mechanical systems and they are in-line with our estimates for these facilities.

Net Difference.....\$4,970,000

Other Costs

Reclamation has a cost for an active solar wall at \$207,000 and dewatering system costs for the equalization and sludge storage tank at \$210,000 and \$120,000, respectively. The elimination of these elements results in a net savings of \$537,000.

Alternative C Evaluation

A cursory review of the Alternative C cost components resulted in one major area of potential cost difference. Reclamation had a cost for the media filters at \$2,300,000. This value appears to be very low. Also, since we are treating raw water that is of a high quality (i.e., low turbidity) the depth of the filter media could be increased. In similar design applications we have used 48 to 60 inches of anthracite over 12 inches of sand.

Current rule of thumb estimating values for media filters is in the range of about \$850,000 per filter box for a standard 460 square foot filter. At 4 gpm per sf, a total of 10 filters would be provided. A rough estimate of the filter costs would be about \$8.5 million. This would include the media, the box, underdrain, surface wash, air scour, filter piping, and controls. It would also include filter to waste provisions.

We would expect a similar cost for the 6 filter box design as proposed by Reclamation. However under a 6-box design it will be harder to achieve flow matching because of the incremental 4.3 mgd filter steps. Using a 10-box design , the filter incremental steps would be 2.6 mgd (2.9 mgd with one filter off-line for backwashing at a total flow of 26 mgd).

Based on this analysis we would add in the range of \$5 million to the estimate for the filter system. We would also strongly recommend using a 10- to 12-filter box design basis to provide better flow control and filter utilization.

Summary

Based on this analysis, the projected cost difference between Alternatives B and C, as revised, would be an additional \$19,800,000 for Alternative B and \$5,000,000 for Alternative C for a total of \$24,800,000.

The cost difference reported in Reclamation's report between the two alternatives was only \$3,580,000 in raw construction costs. After the revised adjustments identified above, the difference Alternative B is projected to be about \$24.8 million less expensive than Alternative C.

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